VMS Video Modular System
Video Modular Systems, Berkeley, CA

The VMS was designed by Bill Etra of Etra Technology Research Associates, Dan Sandin (University of Chicago, Circle Campus) and Lee Felsenstein, with assistance from Bill Hearn (Electronic Associates of Berkeley).

The device could colorize both black &white and color signals, and served as a synthesizer and video graphics system. It also included a computer interface, and was demonstrated using the Radio Shack TRS-80 home computer. It was modular in design, and additional modules included a matrix switcher, a digital pattern generator, an RGB decoder, a real-time processing module, a vector display, video frame buffer and a PAL interface.

VIDEO MODULAR SYSTEMS DESCRIPTION from the product literature

Video Modular Systems (VMS) represent a new approach to the design of video special effects equipment. This set of modules bears little resemblance to commercial video equipment now available on the market.

The best method of describing the system is to relate it to computer architecture. VMS is, in effect, a modular high-speed computer with a bit slice, pipeline architecture. Using the computer model, VMS takes on the following characteristics. The A/D converter is the system's input device for high-speed data. The 8 in-3 out switch is an analog multiplexer for high-speed 1/0. The Firmware Interface Processor/Controller is the slow-speed bus buffer which interprets and formats data from the computer. The maps on the A/D and D/A modules serve as input and output registers for the Central Processing Unit (CPU). Both the Video Processing Unit (VPU) and the Multiplexer Key Matrix (MKM) act as part of the CPU. The MKM controls the data from its low-speed mode and does arithmetic operations in its high-speed mode. The VPU is the major Arithmetic and Logic Unit (ALU) for the CPU. The Pattern Generator is a complex real-time events counter and clock. It provides control over the analog and digital multiplexers on the high-speed bus, as well as special clocking when needed in the VPU.

Every signal in the VMS is based on the system clock. This master clock comes from the RGB encoder and is derived by multiplying the 3.58 color subcarrier by 4, or, in its absence, from its own internal crystal oscillator. The RGB encoder serves as a data translator and formatter, translating the high-speed bus signals back to television signals and adds sync pulses, etcetera. The D/A converter is the final digital buffer; it translates the data to a form acceptable to the RGB encoder. Frame buffers serve as cash memory for the high-speed data, thus allowing the data to be stored and moved, as well as re-formatted. The RGB Decoder is a special data formatter. It allows for individual channel processing of color data.

VMS utilizes a unique concept which allows it to process the high-speed video signal in real-time (Note: Real-time actually refers to a minimal delay-nothing happens instantly). By using the incoming data as address on a number of memory locations and repeating the process with the output of the memory a number of times, various relationships can be set up in the memory (see tables) and complex relationships can be set up between signals. The use of multiple signals as address on the same memory expands this concept and allows all possible combinations to be achieved. With this method in operation, the user need not know the content of the signal in order to process it. One way of understanding the nature of VMS is to consider the logic base of the system. It is based on whatever the video value is during the current sampling period, not on ones or zeroes or positive and negative values. This unique floating number base allows the system to act on video in real-time.

With this unusual architecture, the VMS can accomplish complex operations in real-time while conventional computers would take hours to perform the same calculations (i.e. two dimensional fourier transforms). All video effects now considered standard in the industry are possible within the confines of this system. Certain effects which previously could only be done on expensive picture analysis computer systems can now be handled by VMS. For example, an expanded system can accomplish multiple chromakeys, selecting one or more out of 4096 distinct colors. Sixteen level keys are simple on the high-

speed mode of the multiplexer.  Color convergence error in cameras can be corrected by shifting color fields in the buffers.  The pattern generators yield an infinite number of wipe patterns which can be moved at any rate desired.  Almost all film optical bench effects can be accomplished by the use of the buffers.

A sixteen level colorizer is the most primitive application of the system.  Frame storage permits low resolution time base correction.  "Telistrator" type effects are possible by adding a light pen or tablet.  Action figures may be outlined and tracked by comparing past and current picture fields.

All the effects in the system can be changed every vertical blanking interval.  This means the VMS can achieve images which have the quality of complex post-production editing by changing the control sequence to the modules at a rapid rate, a feature which was hitherto unavailable.  This ability to store the relatively small command sequence in the host computer leads to greater control over the production process.  Effects sequences can be edited and timings modified during rehearsals and production.

Video is image over time with real-time feedback, while film is merely image over time.  In this framework, video more closely resembles music than film.  Music is sound over time with real-time feedback.  The Video Modular System has been designed, in part, to explore this real-time compositional mode, made possible with the editing facilities of the computer.